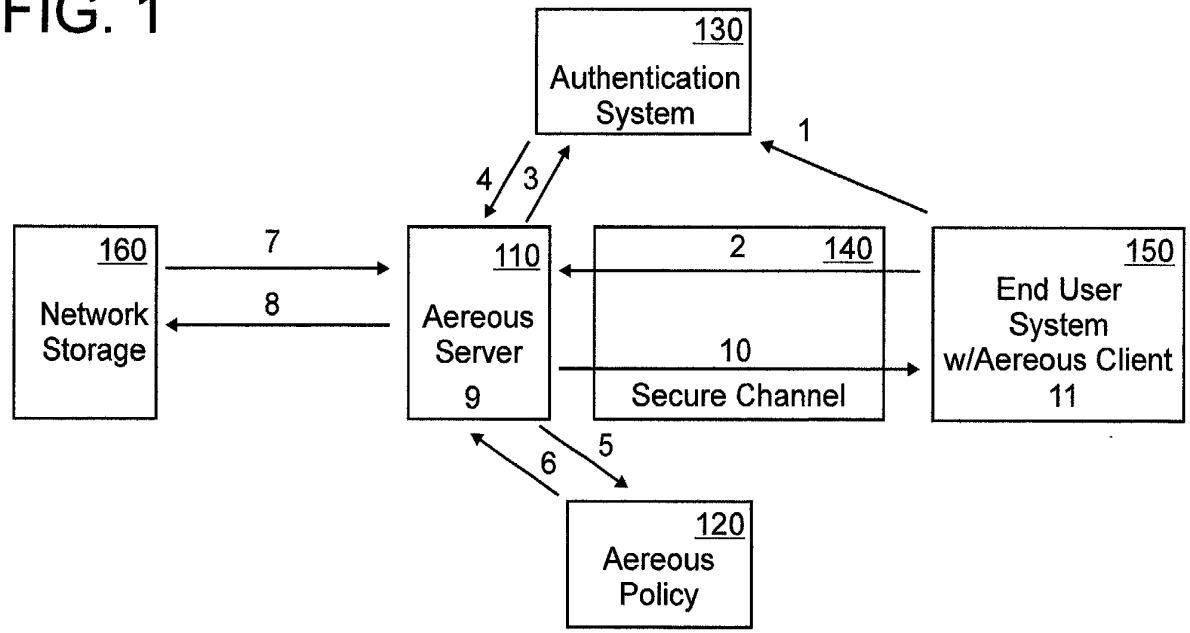
FIG. 1



1 Network User logs into the computer network
2 Network User contacts the Aereous Server to request a file
3,4 Aereous Server contacts the Authentication System to exchange information about the end user.
5,6 Aereous Server contacts the Aereous Policy System and executes the access policy to determine if the user has the privilege to access the file. If the answer is yes, then the usage policy is sent to the Aereous Server, if no then the file is not sent to the end user
7 Aereous Server requests the file from the network storage device
8 Network storage device delivers the file to the Aereous Server
9 Aereous Server applies usage rights to, and encrypts the file
10 The file is securely delivered to the End User System
11 Usage rights and auditing is enforced on the End User System by the Aereous Client

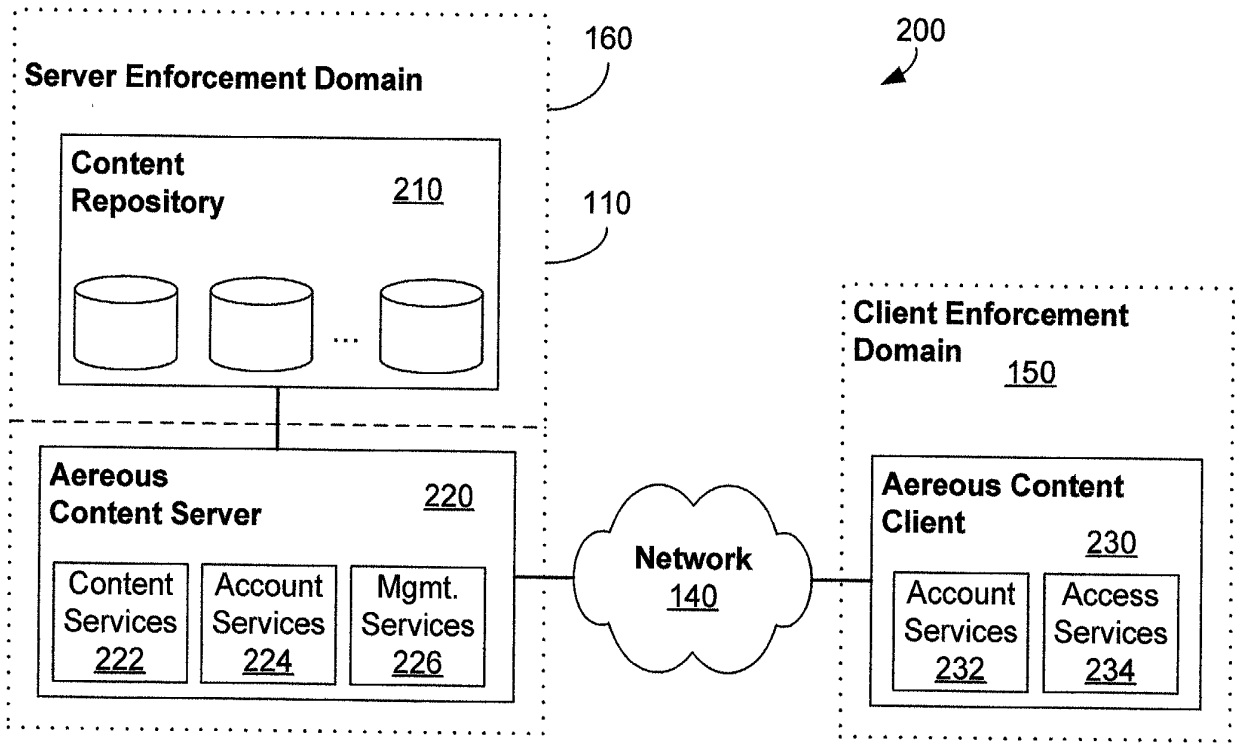

Server Enforcement Domain
160
200
Content Repository
210
110
Client Enforcement Domain
150
Aereous Content Server
220
Content Services
222
Account Services
224
Mgmt. Services
226
Network
140
Aereous Content Client
230
Account Services
232
Access Services
234

FIG. 2

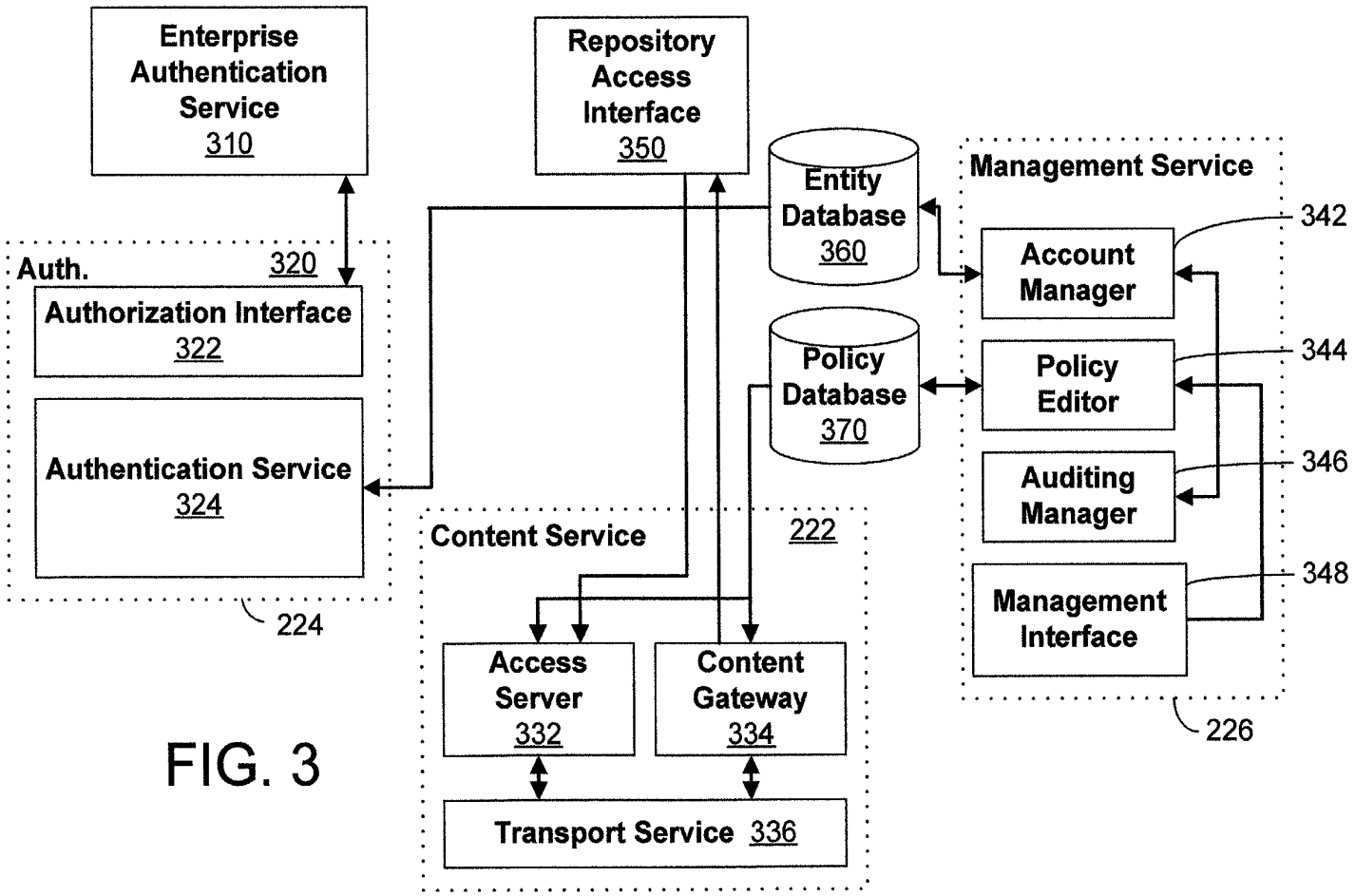

Enterprise Authentication Service 310
Repository Access Interface 350
Entity Database 360
Management Service
342
Account Manager
Auth. 320
Authorization Interface 322
Policy Database 370
344
Policy Editor
Authentication Service 324
346
Auditing Manager
348
Management Interface
Content Service 222
Access Server 332
Content Gateway 334
Transport Service 336
224
226

FIG. 3

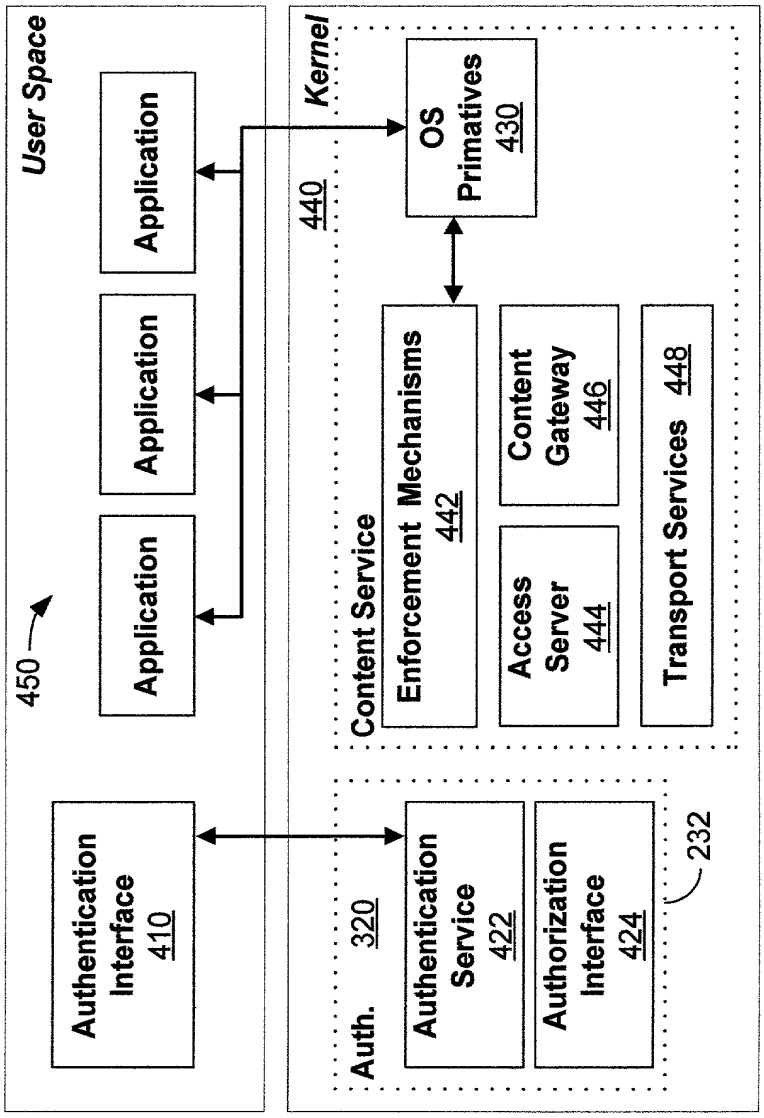
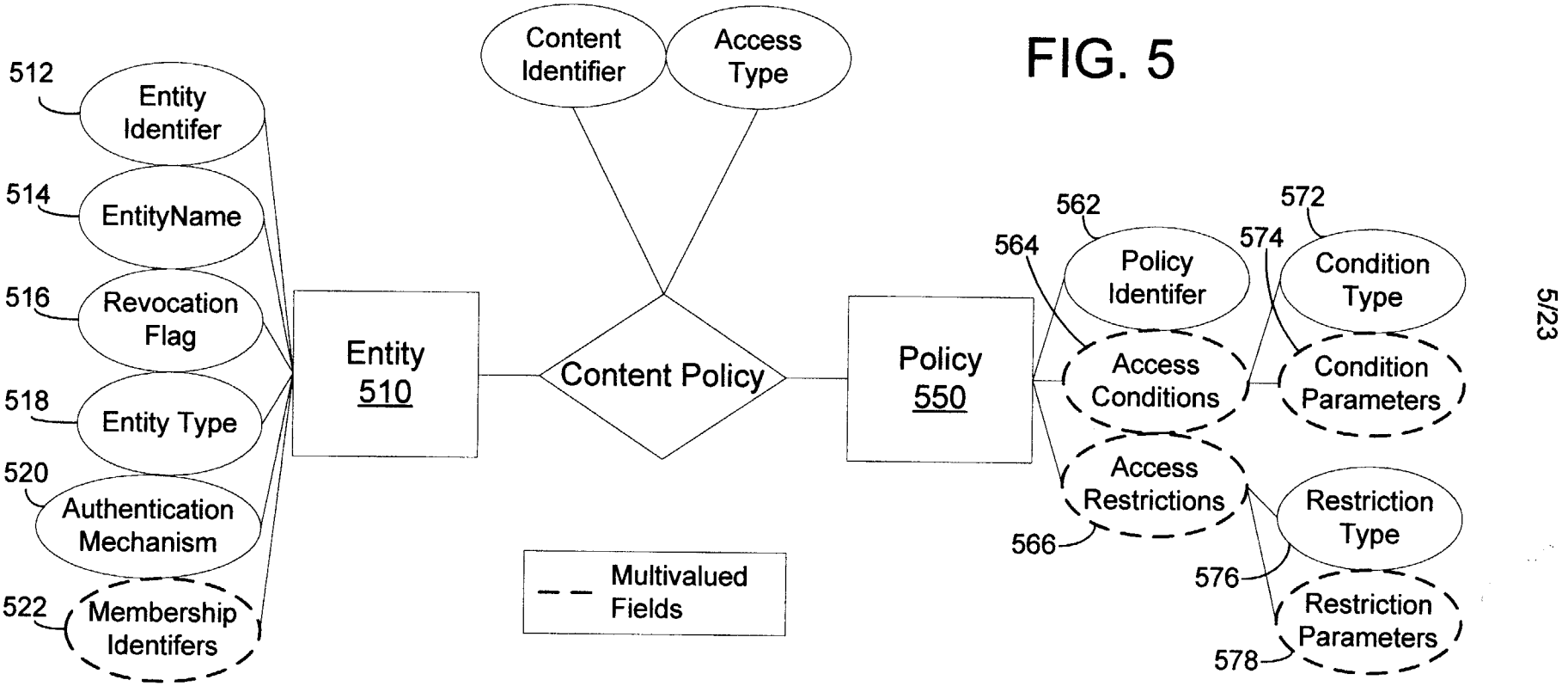

User Space
Kernel
450
Application
Application
Application
Authentication Interface 410
440
OS Primatives 430
Content Service
Enforcement Mechanisms 442
Content Gateway 446
Access Server 444
Transport Services 448
Auth. 320
Authentication Service 422
Authorization Interface 424
232

FIG. 4

FIG. 5



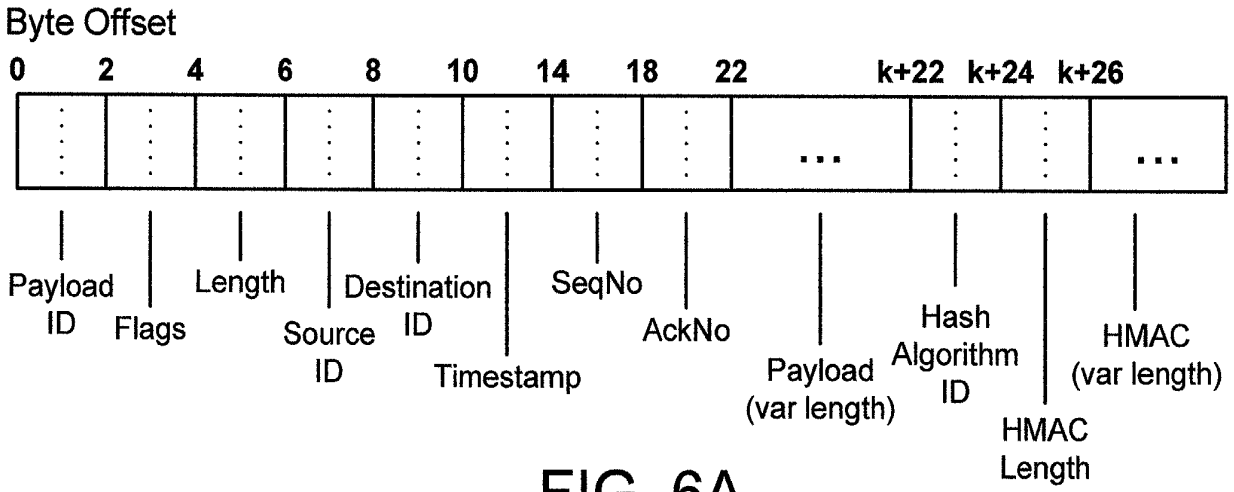

Byte Offset
0
2
4
6
8
10
14
18
22
k+22
k+24
k+26
Payload ID
Flags
Length
Source ID
Destination ID
Timestamp
SeqNo
AckNo
Payload (var length)
Hash Algorithm ID
HMAC Length
HMAC (var length)

FIG. 6A

Field	Length	Description
Payload ID	2 bytes	Enumerated type describing the payload type of the message: Further processing of the message is directed by this field. The currently payload identifiers include: **Type** **Value** **Description** AERE_INVALID 0 Invalid type AERE_FILE_KEY 1 File key payload AERE_BLK_XFER 2 Block transfer AERE_STATUS 3 Aereous status
Flags	2 bytes	Flags indicating payload processing requirements. The currently defined flags include: **Flag** **Bit** **Description** Encrypted 0 Payload encrypted Signed 1 Payload signed (not implemented) Reserved 2-15 *unused*
Length	2 bytes	Length of message, in bytes. This length measures the field through the last byte of the payload.
Source ID	2 bytes	Source identifier – uses user or server entity identifier defined in the entity database.
Destination ID	2 bytes	Recipient identifier – uses user or server entity identifier defined in the entity database.
Timestamp	4 bytes	Timestamp (obtained from local or trusted timing source) of message creation. Used to ensure freshness (e.g., mitigate replay attacks). The time is represented by the standard POSIX 32 bit second identifier (seconds since epoch).
SeqNo	2 bytes	Sequence number used to ensure the ordering of messages.
AckNo	2 bytes	Acknowledgement of all messages up to including *Ackno*.
Payload	*variable*	This is the variable length data to be interpreted by payload processing. The format of the payload is detailed in Section 7.3. Based on message flags, this data require additional process (e.g., encryption, sign).
Hash Algo. Identifier	2 bytes	Enumerate type defining the hash algorithm used in the calculation of the keyed hash. The following hash algorithms are supported by the Aereous system; **Algorithm** **Value** AERE_MD5 0 AERE_SHA1 1
HMAC Length	2 bytes	The length of the HMAC value. Note that some crypgraphic algorithms output more ciphertext than the original plaintext. (Question: Is this really needed, or can we always calculate this from the key/hash algorithm info?)
HMAC	*variable*	This is the keyed hash of the message. This value is calculated over all bytes prior to the beginning of the hash length field.

FIG. 6B

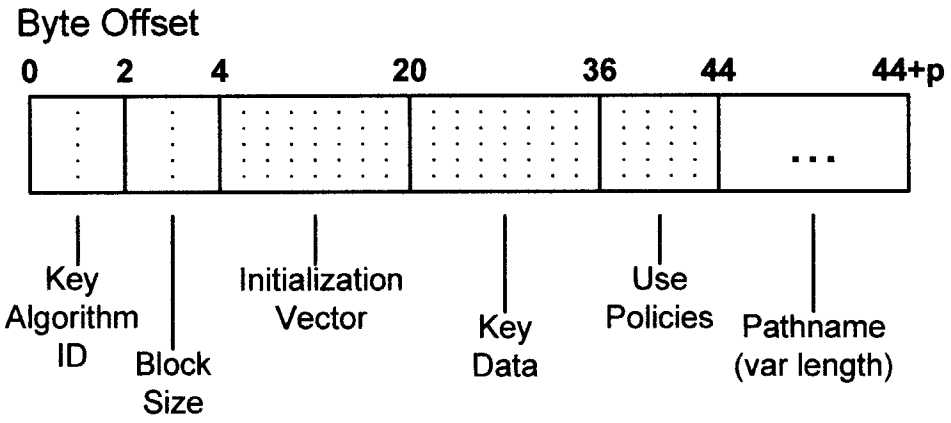
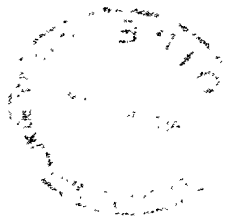


FIG. 7



Name	Length	Description
KeyAlgorithmID	16 bits	(enumerated) identifies both the algorithm and the key length
BlockSize	16 bits	block size for the accessed file
IV	256 bits	Initialization vector used to seed the encryption of file blocks. Further details are defined in Section 7.1.
KeyData	256 bits	The key used to encrypt the file. Where the key size is less than 256 bits, the most significant bits are used and unused bits are padded with zero.
UsePolicies	64 bits	Flags indicating the enabled usage of access content (where a bit 1 = allowed, 0 = denied). The supported bits include: **Flag** **Bit** **Description** Print 0 Print the file Copy 1 Copy file to local disk Send 2 Transmit the file to external device Reserved 3-63 *unused* ***NOTE:*** *The set of usage types are identified in the Aereous Client Design Document, and will be reflected in future version of this document as needed.*
Pathname	(variable)	full pathname of file being accessed

FIG. 8

Name	Length	Description
Cid	16 bits	hashed pathname identifier (see Section 6)
Block/Number	16 bits	block number of transmitted data
Length	16 bits	length of data, typically equal to the block size supported by the filesystem
Data	(variable)	the file data

FIG. 9

Name	Length	Description
Sid	16 bits	(enumerated) Type identifying the message semantics. *Details of the status are further specified in the info and text fields.* **Enum** / **Numeric** / **Origin** / **Description** usageExec / 0 / client / Usage right executed aereousError / 1 / both / Aereous error encountered dfsError / 2 / both / Filesystem error infoStatus / 3 / both / informational (e.g., debugging) clientShutdown / 4 / client / client shutdown signal serverShutdown / 5 / server / server shutdown signal *unused* / 6-2-- / N/A / *unused*
Infolength	16 bits	length of *info* field
Info	(variable)	Additional status information. The interpretation of this field is directed by the *Sid* field as follows: **Enum** / **Subfields** usageExec / content ID (*cid*), usage mask aereousError / Aereous error code dfsError / standard UNIX errno infoStatus / information enum clientShutdown / *none* serverShutdown / *none* *unused* / *unused*
TextLength	16 bits	length of *Text* field
Text	(variable)	C-string description of information. Used in auditing or as user notification.

FIG. 10

FIG.11

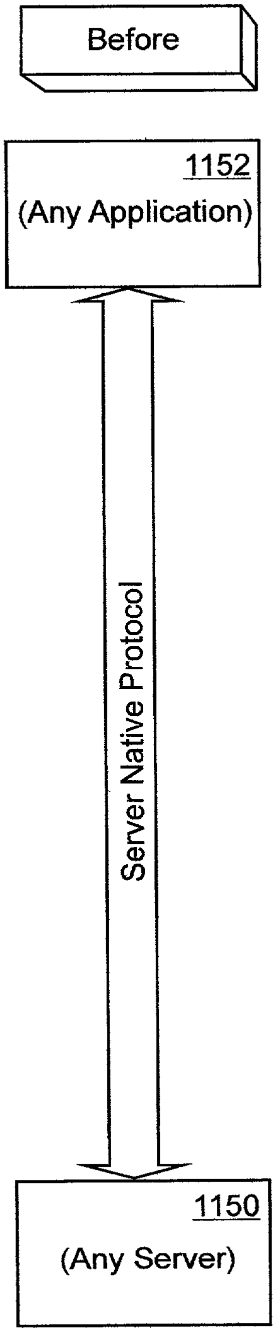
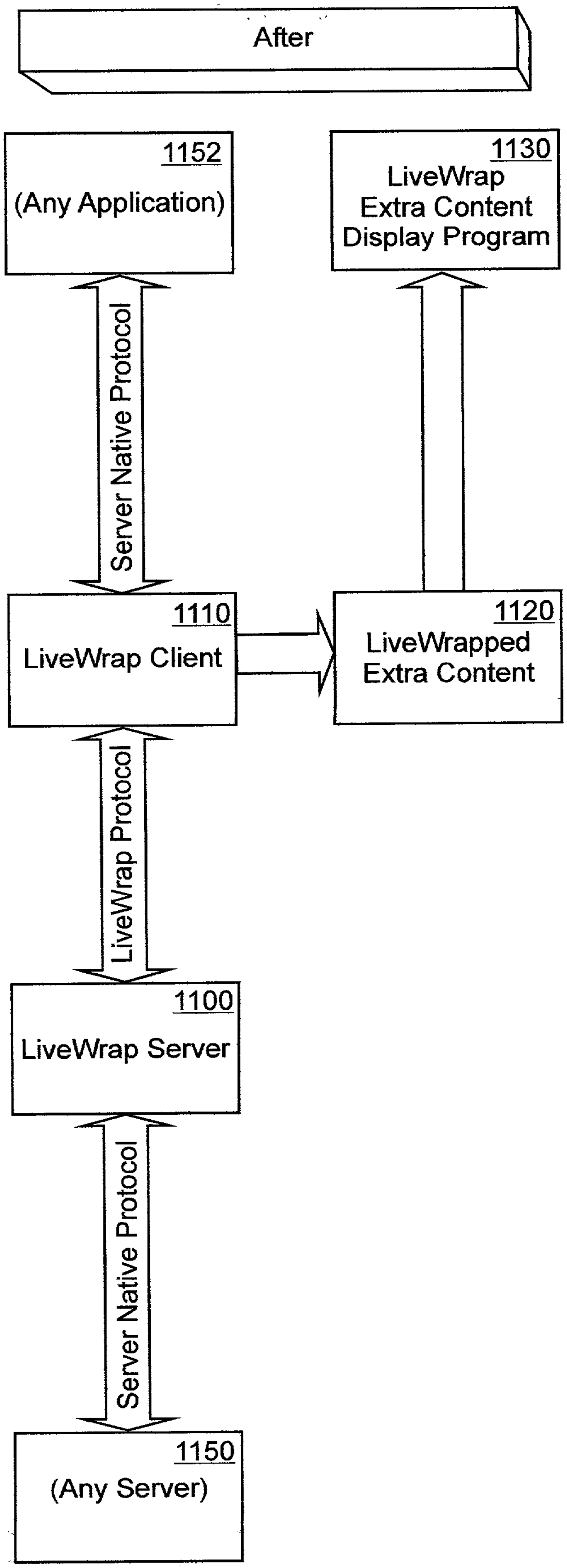

Before
1152
(Any Application)
Server Native Protocol
1150
(Any Server)

FIG. 12


After
1152
(Any Application)
1130
LiveWrap
Extra Content
Display Program
Server Native Protocol
1110
LiveWrap Client
1120
LiveWrapped
Extra Content
LiveWrap Protocol
1100
LiveWrap Server
Server Native Protocol
1150
(Any Server)

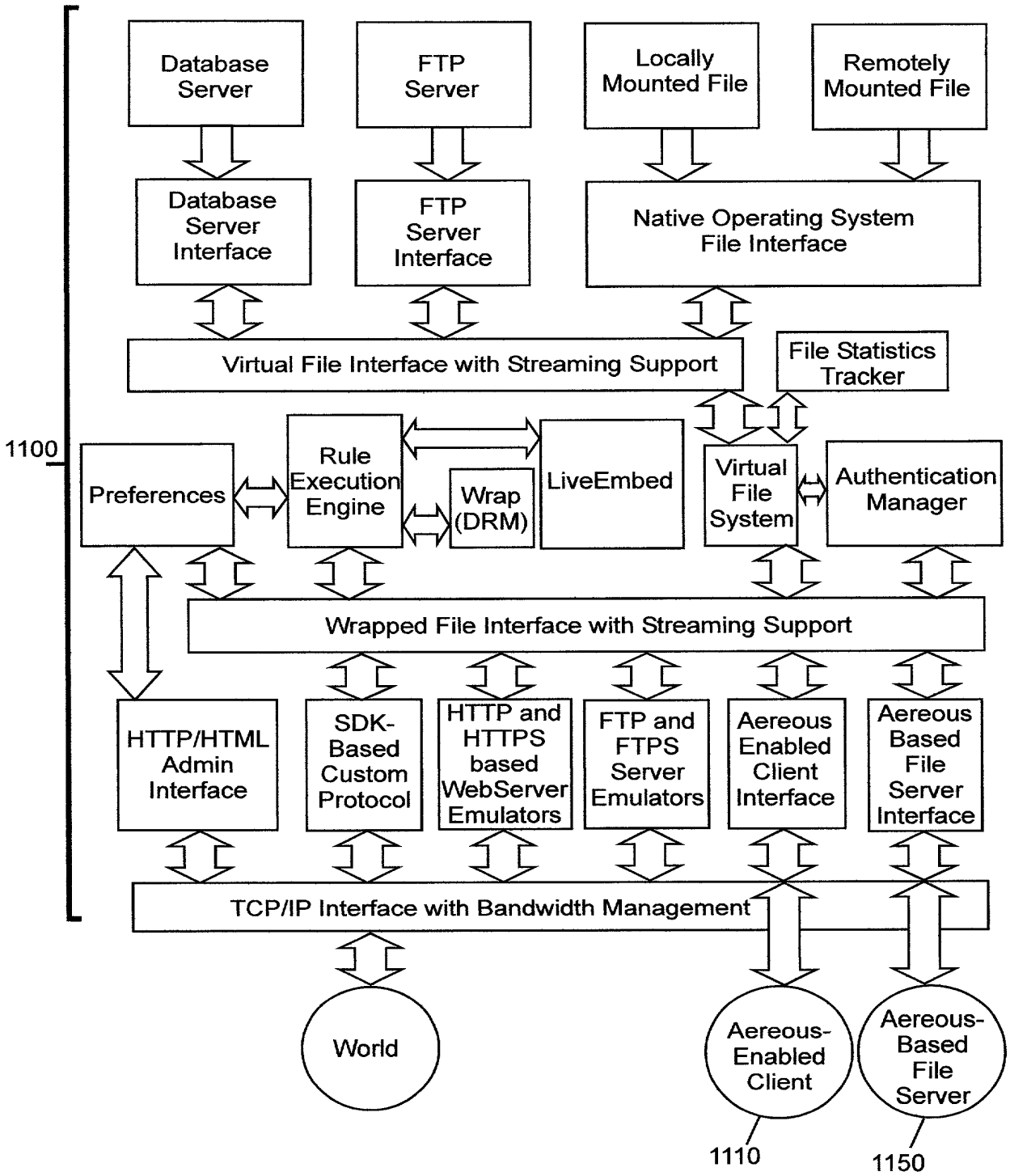

Database Server
FTP Server
Locally Mounted File
Remotely Mounted File
Database Server Interface
FTP Server Interface
Native Operating System File Interface
Virtual File Interface with Streaming Support
File Statistics Tracker
1100
Preferences
Rule Execution Engine
Wrap (DRM)
LiveEmbed
Virtual File System
Authentication Manager
Wrapped File Interface with Streaming Support
HTTP/HTML Admin Interface
SDK-Based Custom Protocol
HTTP and HTTPS based WebServer Emulators
FTP and FTPS Server Emulators
Aereous Enabled Client Interface
Aereous Based File Server Interface
TCP/IP Interface with Bandwidth Management
World
Aereous-Enabled Client
Aereous-Based File Server
1110
1150

FIG. 13

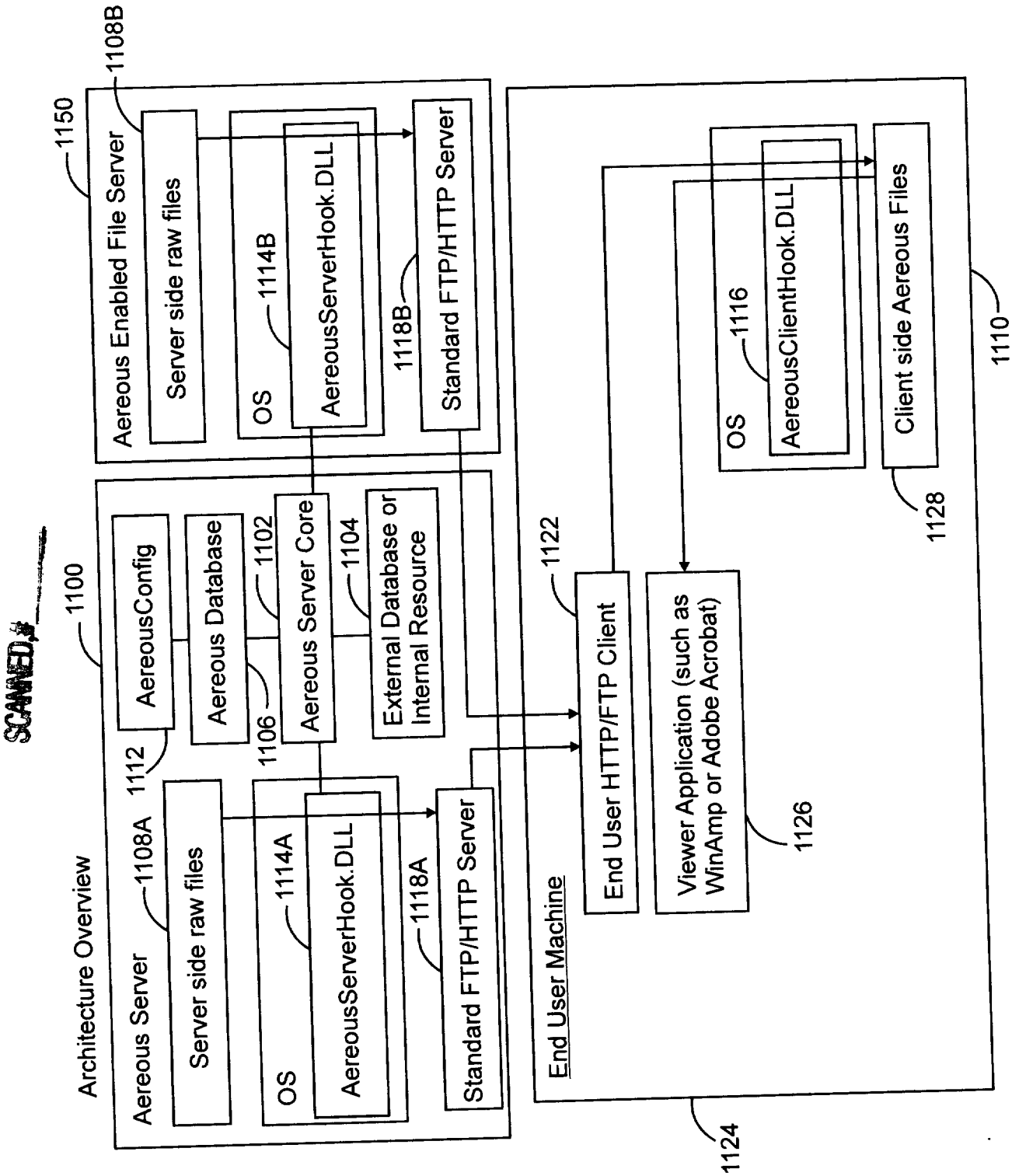

Architecture Overview
1100
Aereous Server
1108A
Server side raw files
OS
1114A
AereousServerHook.DLL
1118A
Standard FTP/HTTP Server
1112
AereousConfig
Aereous Database
1106
1102
Aereous Server Core
1104
External Database or Internal Resource
1150
Aereous Enabled File Server
1108B
Server side raw files
OS
1114B
AereousServerHook.DLL
1118B
Standard FTP/HTTP Server
1122
End User HTTP/FTP Client
Viewer Application (such as WinAmp or Adobe Acrobat)
1126
End User Machine
1124
OS
1116
AereousClientHook.DLL
Client side Aereous Files
1128
1110

FIG. 14

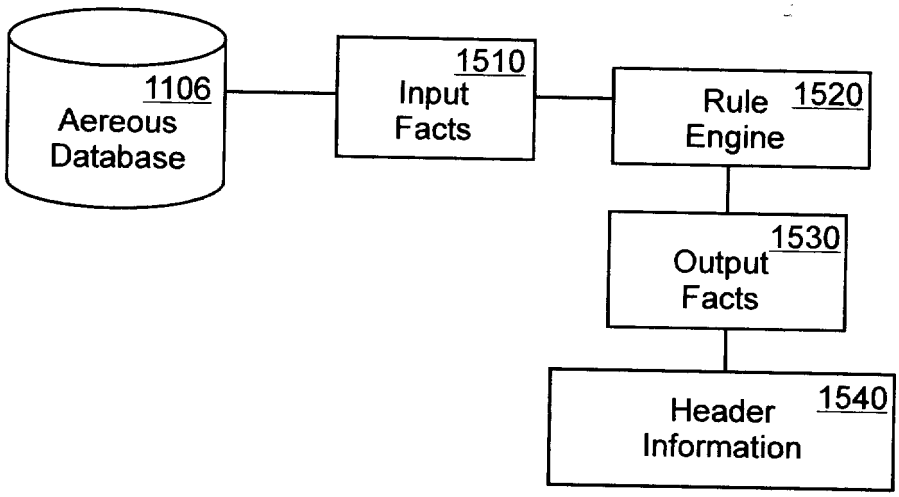


FIG. 15

AereousServer Core Plug-in Architecture

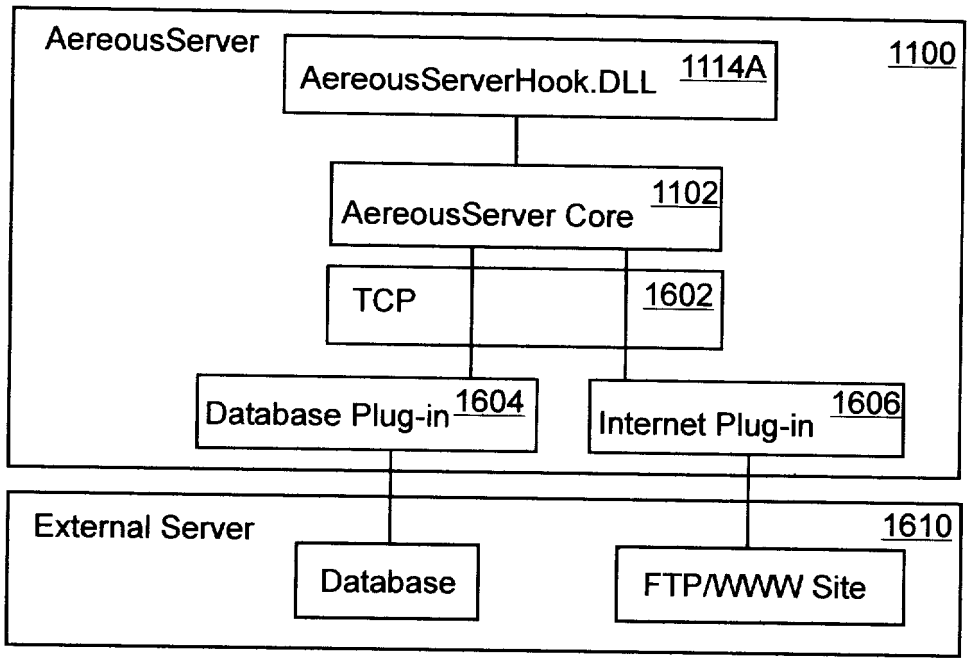


FIG. 16

File Server Example Interaction Diagram

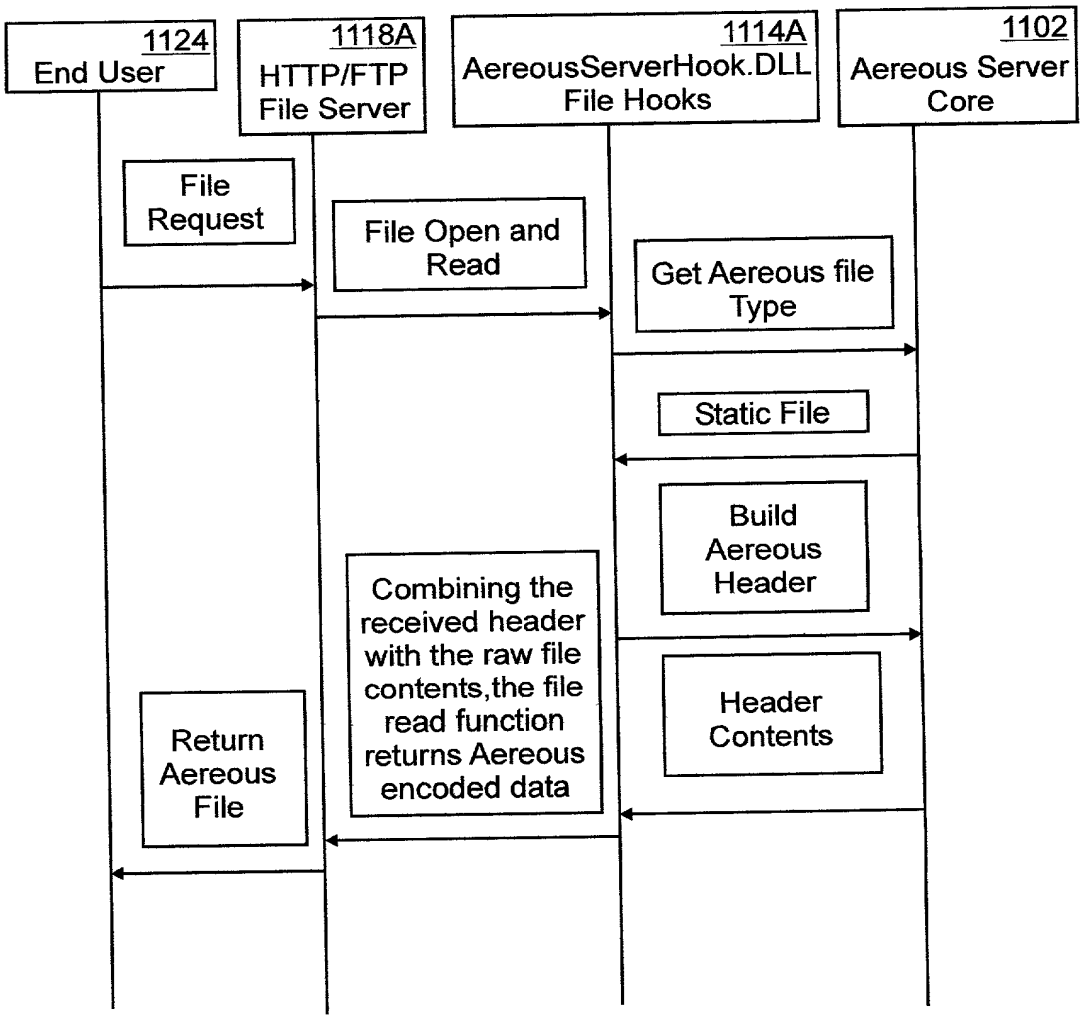


FIG. 17

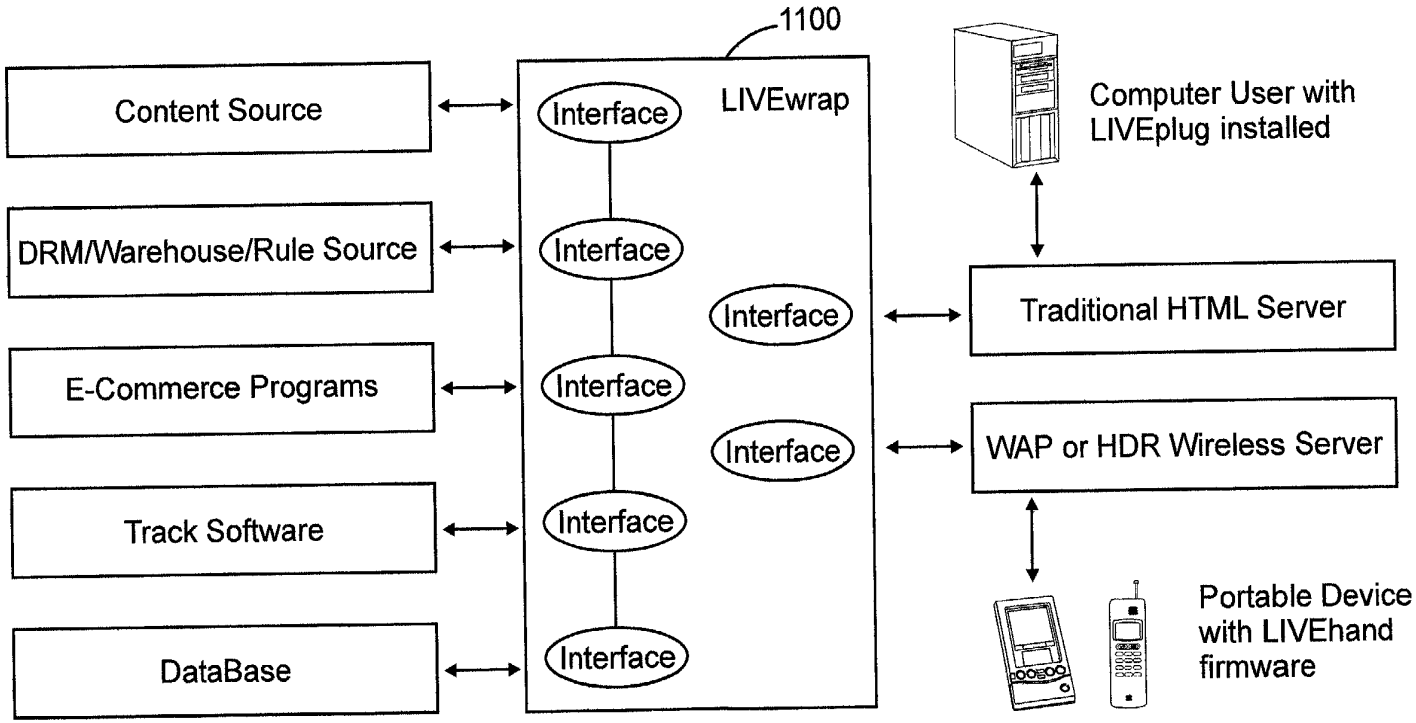

1100
Content Source
DRM/Warehouse/Rule Source
E-Commerce Programs
Track Software
DataBase
Interface
Interface
Interface
Interface
Interface
LIVEwrap
Computer User with
LIVEplug installed
Traditional HTML Server
WAP or HDR Wireless Server
Portable Device
with LIVEhand
firmware

FIG. 18

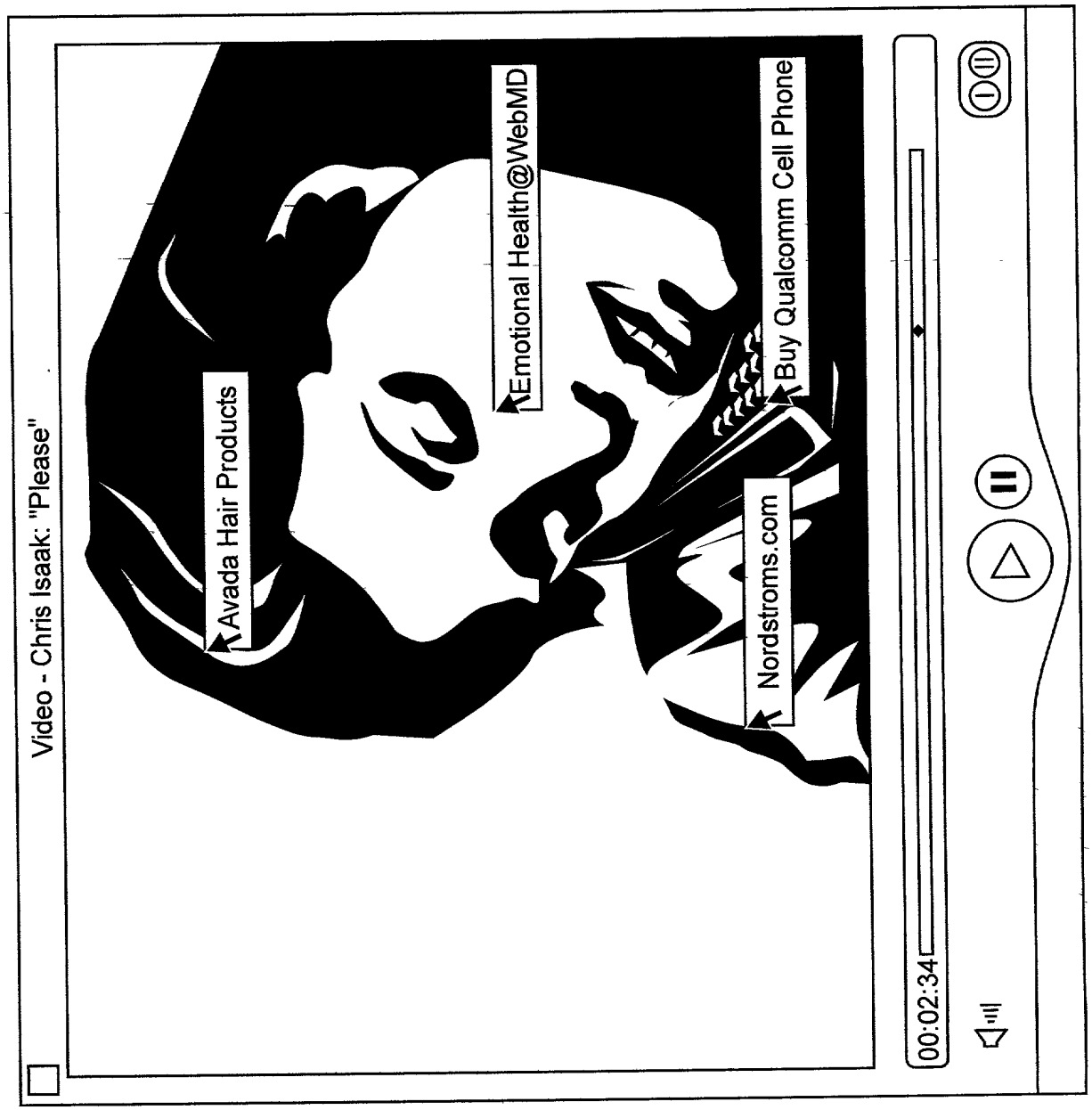

Video - Chris Isaak: "Please"
Avada Hair Products
Emotional Health@WebMD
Buy Qualcomm Cell Phone
Nordstroms.com
00:02:34

FIG. 19

Start: 7/30/00 11:49:07 PM
PING from: 24.160.215.100
to: www. .com

PKT#	RESULT	TIME(ms)	LENGTH	Every 500 mSecs Min	Avg	Max	Timestamp	
1	success	176	40	176	176	176	7/30/00	11:49:07 PM
2	success	134	40	134	155	176	7/30/00	11:49:08 PM

Packets out/in/bad/λ loss = 2/2/0/0.0
Round Trip Time (ms) min/avg/max = 134/155/176
• Ping Completed 7/30/00 11:49:08 PM •

FIG. 20

Description	Size (bytes)	Contents
Aereous Signature	11	'AEREOUS' + 0x01301976
Aereous File Version	1	Currently 0x1
File ID	8	File's Aereous ID.
Usage Count	2	Number of usages remaining. Set to 0xFFFF for infinite usages.
Expiration Date	4	A GMT ANSI RTL style time date stamp that indicates when this file expires.
Usage Denied Content	Varying	Once a read attempt fails due to a 0 usage count, this content is displayed to the user. The format is described below under "Content Format."
Number of Push Content Items	2	Number of items that are pushed to the use when the file is opened.
Push Content Items	Varying	Array of push content items. The format is described below as "Push Content Item Format."
Header CRC	4	A CRC value for the preceding header bytes.
Content Size	8	The size of the unencrypted data
Encryption Type	1	0 = Unencrypted 1 = 2Fish 2-255 = undefined
Encrypted Data Offset	8	A file offset to the beginning of the encrypted data. The encrypted data uses the format described in "Encrypted Data Block."

FIG. 21

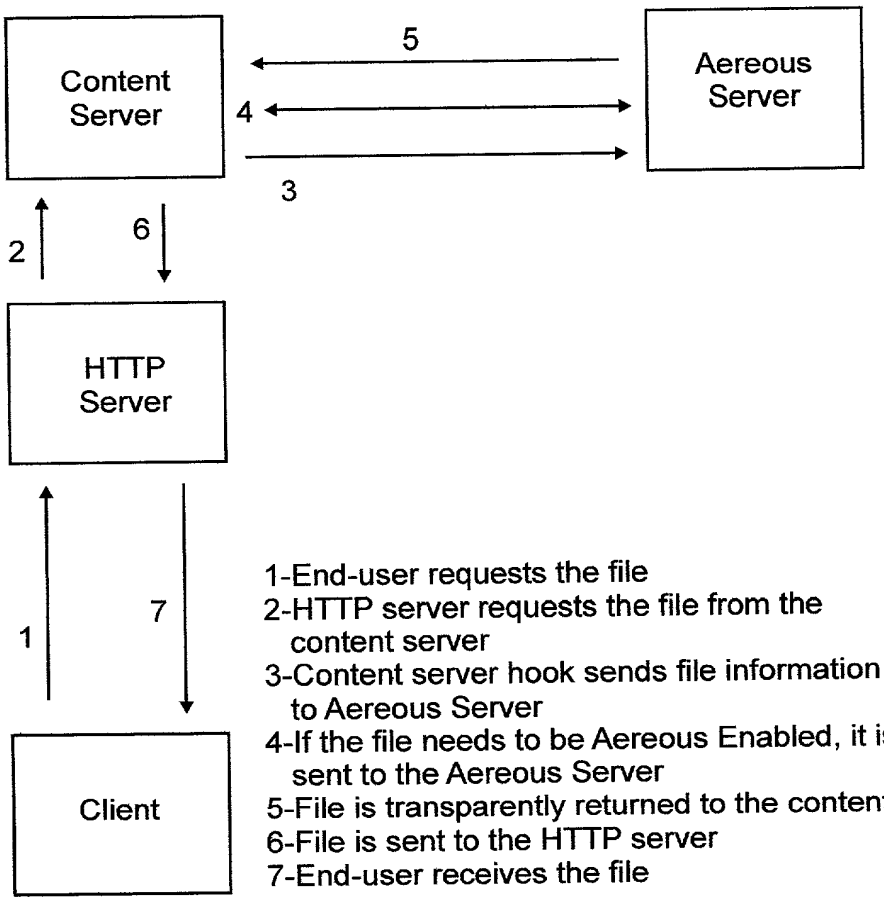

Content Server
Aereous Server
HTTP Server
Client
5
4
3
2
6
1
7
1-End-user requests the file
2-HTTP server requests the file from the content server
3-Content server hook sends file information to Aereous Server
4-If the file needs to be Aereous Enabled, it is sent to the Aereous Server
5-File is transparently returned to the content server
6-File is sent to the HTTP server
7-End-user receives the file

FIG. 22

FIG. 23

VirtualFile

The VirtualFile table lists all files in the system. Each file is associated with a Plug-In and a bundle of facts that are understandable by that Plug-In.

Column	Type	Description	Sample
*VirtualFile ID	Int	System assigned ID	314
Name	Text	Name of the virtual file. This is the base name, with no parent directory names and no directory separator characters. The name is not case sensitive in the server core, but is allowed to be in the database engine.	SalesReport .doc
IsDefault	Bool	Flag indicating whether Name is actually a wildcard pattern match. Use of this flag allows directories to be setup and facts associated with them without having to database each of the files that could reside within that virtual directory.	False
VirtualDirectoryID (optional)	Int	ID of the VirtualDirectory that the file resides within. Use NULL for files that reside at the root level.	4242
PlugInName	Text	Identifies which plug-in will generate the actual file contents.	FTP
IsStatic	Bool	Flag indicating whether the file is an actual static file on the server disk of a true virtual file.	True
FactBundleID (optional)	Int	Facts for this file. These facts are considered to be "owned" by this file and will be deleted if this file entry is deleted.	4243
SharedFactBundleID (optional)	Int	Facts for this file. These facts are not "owned" by this file, instead existing as shared facts to assist with centralized administration.	12000
ShouldLogUsageEvents	Int	Flag indicating whether any access to this file should result in an access log. • 1 indicates there should be a log generated • 0 means no log should be generated • Null or –1 means that the value of this setting should be inherited from the parent directory or the DefaultShouldLogUsageEvents configurable parameter	1

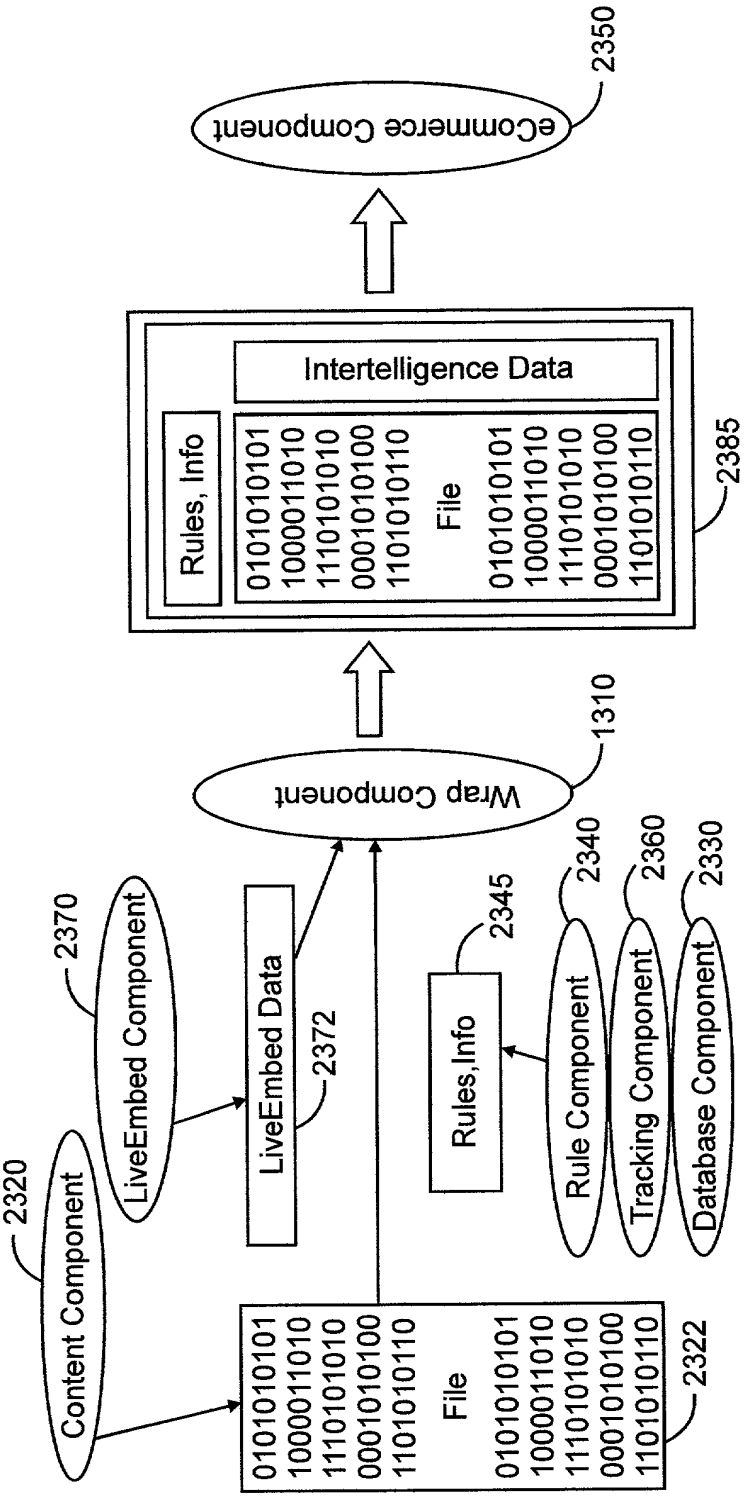
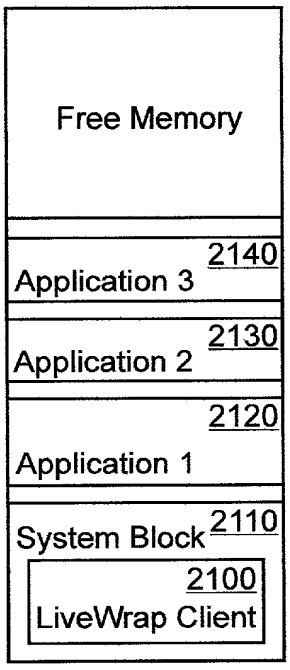

eCommerce Component
2350
Intertelligence Data
Rules, Info
0101010101
1000011010
1110101010
0001010100
1101010110
File
2385
Wrap Component
1310
Content Component
2320
LiveEmbed Component
2370
LiveEmbed Data
2372
Rules,Info
2345
Rule Component
2340
Tracking Component
2360
Database Component
2330
File
2322

FIG. 24



Client Memory Space

FIG. 25